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**BIOLOGY
HIGHER LEVEL
PAPER 1**

Thursday 17 May 2012 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is *[40 marks]*.

1.

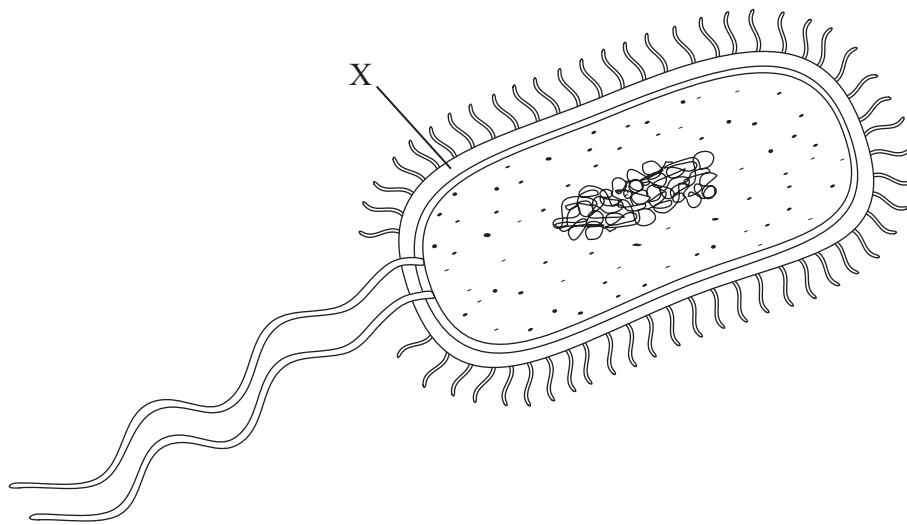
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2. How do cells in multicellular organisms differentiate?
- A. Some cell types divide by mitosis more often than others.
 - B. They express some of their genes but not others.
 - C. Some of their proteins denature but not others.
 - D. Their DNA content changes with time.

3. What is an example of the therapeutic use of stem cells?

- A. Sequencing the human genome
- B. Forensic investigations of paternity
- C. Production of genetically modified crops
- D. Restoration of insulation tissue in neurons

4. The diagram shows the structure of a bacterium.

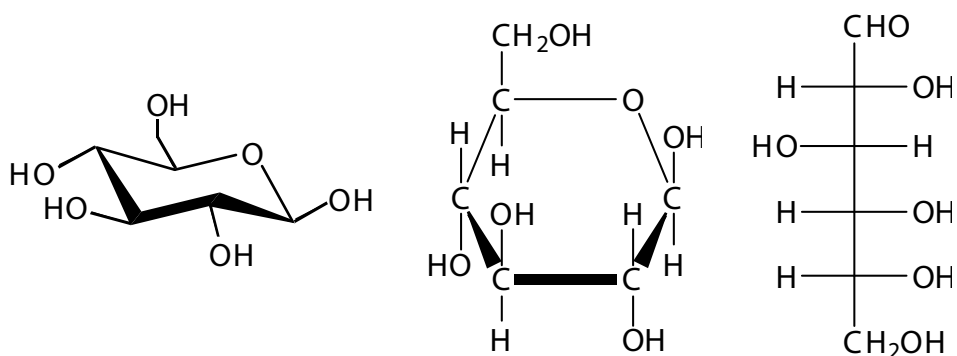


What is the structure labelled X?

- A. Pilus
- B. Cell wall
- C. Cytoplasm
- D. Cell membrane

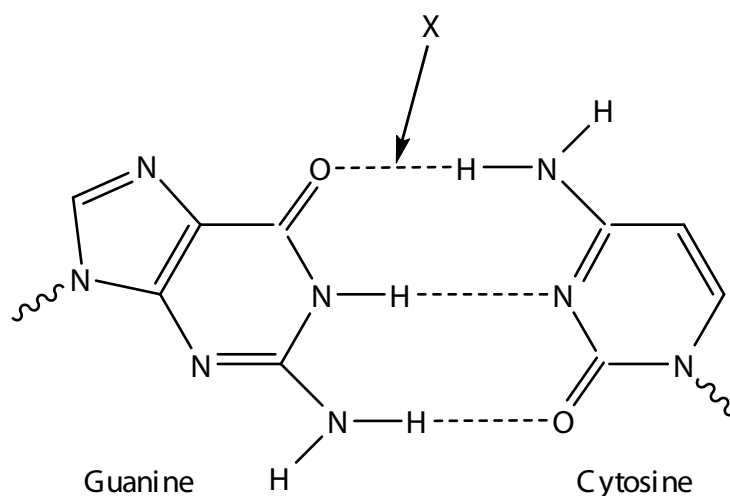
5. What is the approximate thickness of the plasma membrane of a cell?
- A. 10 nm
 - B. 50 nm
 - C. 10 μm
 - D. 50 μm
6. What is a role of iron in living organisms?
- A. Helps build stronger, denser bones and teeth
 - B. Helps maintain the tertiary structure of proteins
 - C. Strengthens the cell wall in plants
 - D. Forms part of oxygen carrier proteins such as hemoglobin and myoglobin

7. The diagrams show three representations of the structure of the **same** chemical substance.



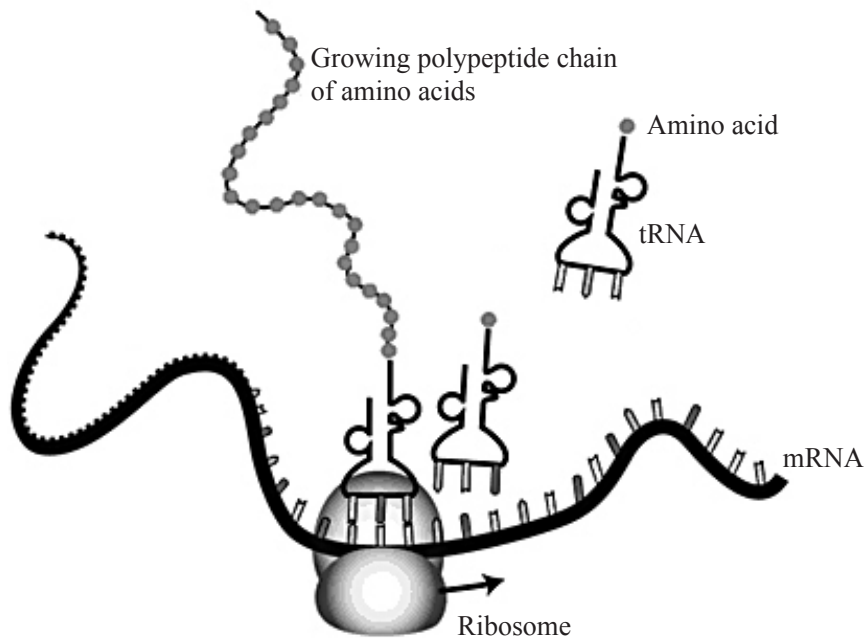
What chemical substance is shown?

- A. Ribose
 - B. Glucose
 - C. Fatty acid
 - D. Amino acid
8. What type of bond is labelled X?



- A. Ionic
- B. Peptide
- C. Covalent
- D. Hydrogen

9. The diagram shows the translation of a mRNA molecule.



[Source: National Human Genome Research Institute]

A tRNA molecule with anticodon CAG carries the amino acid phenylalanine. Which codon of mRNA will the tRNA join?

- A. CTG
- B. CAG
- C. GTC
- D. GUC

10. The graph shows the absorption spectrum of three different pigments.

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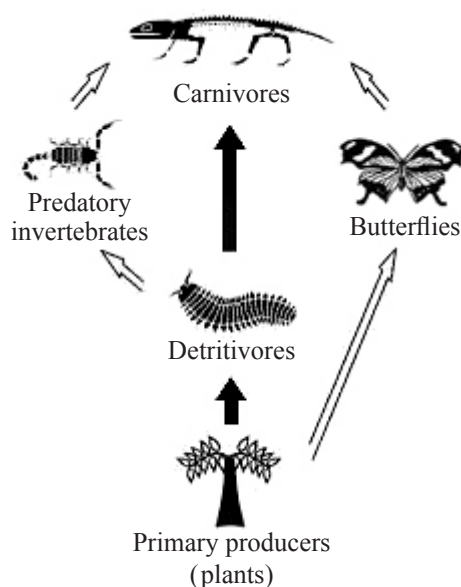
[Please refer to the graph at <http://www.uic.edu/classes/bios/bios100/lecturesf04am/lect10.htm>
under the heading of “The light-dependent reactions”]

What is shown in the graph?

- A. The pigments absorb almost all green and yellow light.
 - B. Carotenoids absorb best in orange light.
 - C. The rate of photosynthesis is lowest in blue light.
 - D. Chlorophyll b absorbs best in blue light.
11. What is a gene mutation?
- A. Failure of chromosome pairs to separate properly during cell division
 - B. Changes to genes caused by natural selection
 - C. Changes to the nucleotide sequence of the genetic material
 - D. Changes in karyotypes

- 12.** What is meiosis?
- A. Division of a diploid nucleus to form diploid nuclei
 - B. Reduction division of a haploid nucleus to form diploid nuclei
 - C. Reduction division of a diploid nucleus to form haploid nuclei
 - D. Division of a haploid nucleus to form haploid nuclei
- 13.** Which is a source of chromosomes for pre-natal diagnosis of abnormalities by karyotyping?
- A. Sperm
 - B. Ovaries
 - C. Erythrocytes
 - D. Chorionic villi
- 14.** What is a plasmid?
- A. Chloroplast DNA
 - B. Mitochondrial DNA
 - C. Small circle of DNA that can transfer genes to or from a prokaryote
 - D. The bacterial chromosome
- 15.** What best describes the mode of nutrition of a heterotroph?
- A. It ingests only non-living organic matter.
 - B. It obtains organic molecules from other organisms.
 - C. It synthesizes its organic molecules from inorganic substances.
 - D. It produces its organic molecules from chemical reactions using light.

Questions 16 and 17 refer to the following food web.



[Adapted with permission from <http://jogginsfossilcliffs.net/cliffs/biodiversity/>]

16. The energy passing from the detritivores to the predatory invertebrates in this food web is $14\,000\text{ kJ m}^{-2}\text{ year}^{-1}$. Approximately how much energy (in $\text{kJ m}^{-2}\text{ year}^{-1}$) passes from the predatory invertebrates to the carnivores?
- A. 140
 - B. 1400
 - C. 14 000
 - D. 140 000
17. To which trophic level do the butterflies belong?
- A. Producers
 - B. Primary consumers
 - C. Secondary consumers
 - D. Tertiary consumers

18. What type of process causes antibiotic resistance to develop in bacteria?

- A. Competition with viruses
- B. Overproduction of offspring
- C. Evolution due to environmental change
- D. Response by bacteria to an epidemic

19. What is an important function of the lacteal in the villus?

- A. Secretion of mucus
- B. Secretion of enzymes
- C. Transport of glucose
- D. Transport of fats

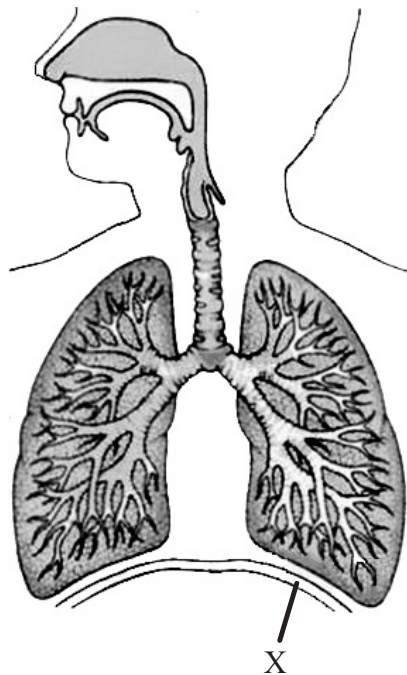
20. Which blood vessel directly supplies oxygen to the heart muscle?

- A. Aorta
- B. Coronary artery
- C. Pulmonary artery
- D. Pulmonary vein

21. What is a long-term effect of HIV on the immune system?

- A. Increase in leucocytes
- B. Reduction in erythrocytes
- C. Increase in antibody production
- D. Reduction in active lymphocytes

22. The diagram shows the ventilation system in humans.



What is the function of the structure labelled X?

- A. Protect the lungs
 - B. Contract to cause inhalation
 - C. Become flatter to move the ribcage up
 - D. Relax in order to increase the thoracic capacity
23. Which of the following are controlled by homeostasis?
- I. Blood pH
 - II. Water balance
 - III. Blood glucose concentration
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

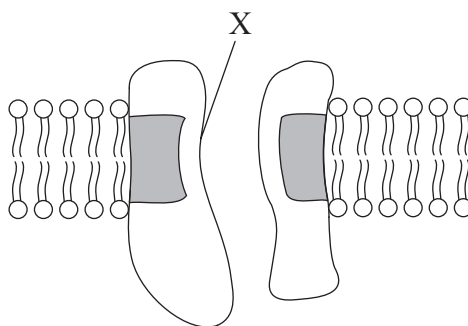
24. Which of the following help to control body temperature on a very hot day?

- I. Shivering
 - II. Sweating
 - III. Skin arteriole dilation
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

25. What is a nucleosome?

- A. A region in a prokaryotic cell where DNA is found
- B. A DNA molecule wrapped around histone proteins
- C. A ribosome of a prokaryotic cell
- D. A molecule consisting of a sugar, a base and a phosphate

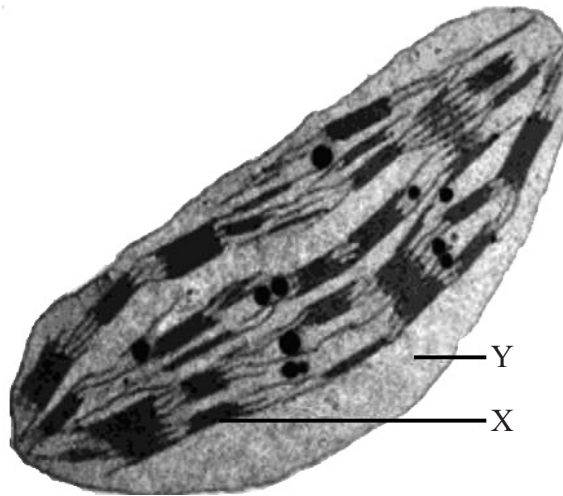
26. The diagram shows the cross section of a plasma membrane.



What is found in area X?

- A. Glycolipid
 - B. Glycoprotein
 - C. Polar amino acid
 - D. Non-polar amino acid
27. How does a competitive inhibitor interact with an enzyme?
- A. It binds to the active site, denaturing the enzyme.
 - B. It binds to the active site, preventing substrate binding.
 - C. It binds to an allosteric site, causing conformational change of the enzyme.
 - D. It binds to the allosteric site, causing competition with the substrate.
28. What occurs during oxidative phosphorylation?
- A. ATP production using electrons from NADP
 - B. Coupling of ATP synthesis to electron transport
 - C. Chemiosmosis in the matrix of the mitochondrion
 - D. Release of energy as ATP reacts with oxygen

Questions 29 and 30 refer to the following electron micrograph of a chloroplast.



[Source: www.uic.edu/classes/bios/bios100/lecturesf04am/lect10.htm]

29. What is the structure labelled X?

- A. Stroma
- B. Granum
- C. Crista
- D. Starch granule

30. What is a function of Y?

- A. Carbon fixation
- B. Absorption of light
- C. Storage of glucose
- D. Production of ATP

31. What is a tendril?

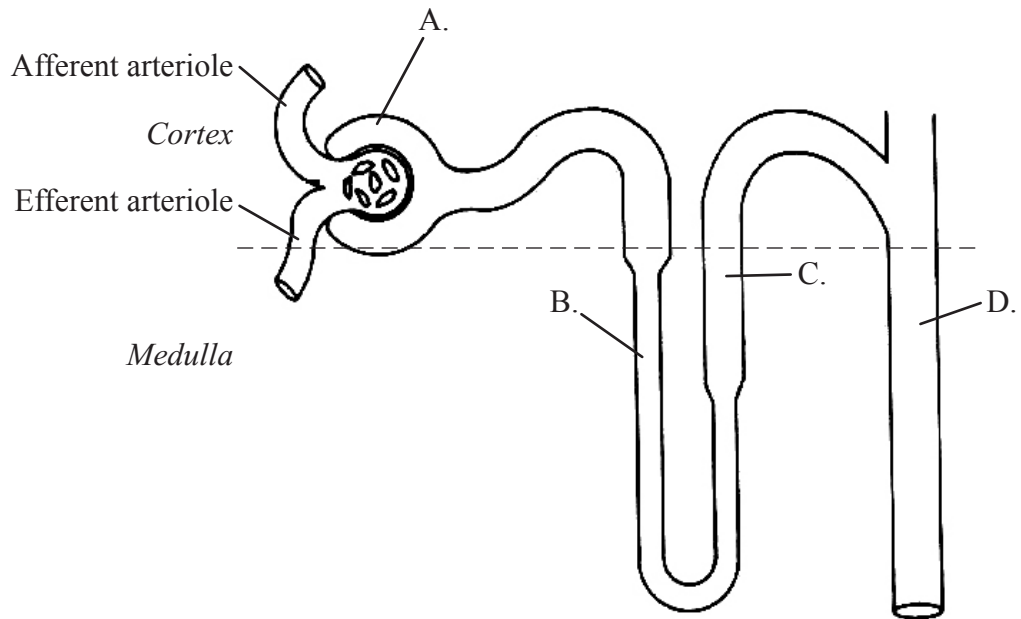
- A. Needle-like extension of the cortex and epidermis for protection
- B. Modified leaf to prevent evaporation
- C. Thread-like structure used by climbing plants for support and attachment
- D. Seed coat used for protection

32.

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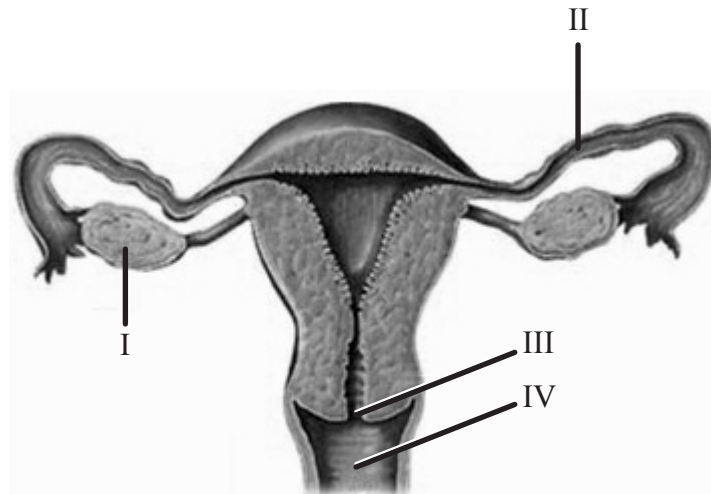
- 33.** What does far-red absorbing phytochrome (P_{fr}) cause in flowering plants?
- A. It inhibits flowering in long-day plants when nights are long.
 - B. It promotes flowering in short-day plants when nights are long.
 - C. It promotes flowering in short-day plants when nights are short.
 - D. It promotes flowering in long-day plants when nights are short.
- 34.** What causes genetic variety in the formation of gametes during meiosis?
- A. Crossing over in prophase I and random orientation of homologous chromosomes in metaphase I
 - B. Crossing over in metaphase I and random orientation of homologous chromosomes in metaphase II
 - C. Linkage of genes in prophase I and crossing over in metaphase I
 - D. Linkage of genes in metaphase I and random orientation of homologous chromosomes in metaphase II
- 35.** What is clonal selection?
- A. Production of memory B cells
 - B. Production of a group of identical organisms
 - C. Passive immunity as a result of inoculation with antibodies
 - D. Mitotic division of B cells activated in response to an infection
- 36.** What is the role of ligaments in humans?
- A. To hold bones together
 - B. To hold muscles together
 - C. To attach bones to muscles
 - D. To attach nerves to muscles

37. The diagram shows the nephron in a kidney. Which labelled part is permeable to sodium and not to water?



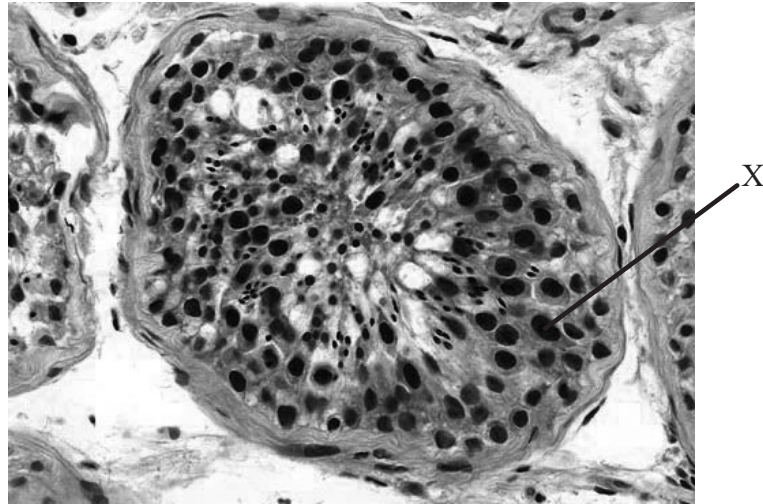
[Source: www.medcyclopaedia.com/upload/book%20of%20radiology/chapter25/nic_k251_295.jpg]

38. The diagram shows the adult female reproductive system. Which label shows the cervix and which shows the usual site of fertilization?



	Cervix	Site of fertilization
A.	I	II
B.	II	IV
C.	III	II
D.	IV	III

39. The micrograph shows the structure of a testis undergoing spermatogenesis.



[Image courtesy of WebPathology.com]

What is the structure labelled X?

- A. Sperm
 - B. Sertoli cell
 - C. Leydig cell
 - D. Germinal epithelium cell
40. Which is the correct sequence of stages in fertilization?
- A. cortical reaction → penetration of the egg membrane → acrosome reaction
 - B. cortical reaction → acrosome reaction → penetration of the egg membrane
 - C. acrosome reaction → cortical reaction → penetration of the egg membrane
 - D. acrosome reaction → penetration of the egg membrane → cortical reaction